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METHOD FOR DETERMINING LIFE OF GRAPHITE CRUCIBLES

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METHOD FOR DETERMINING LIFE OF GRAPHITE CRUCIBLES

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METHOD FOR DETERMINING LIFE OF GRAPHITE CRUCIBLES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 18 September 1981, after the draft finalized by the Refractories Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 Clay-bonded graphite crucibles are used extensively by ferrous and non-ferrous industries. However, facilities for testing the various properties specified in IS:8977-1978* are very few. Hence the users generally assess the quality of the crucible by its life, that is, the number of times it can be used for melting metal.

0.3 This standard is being formulated with a view to rationalizing the method to be adopted for assessing life of graphite crucible.

1. SCOPE

1.1 This standard prescribes the method for determining life of clay-bonded graphite crucibles.

2. PRINCIPLE OF TEST

2.1 The crucible under test is preheated before it is filled to capacity with a specific composition of brass. It is then heated to melt the contents and the molten material is poured out of the crucible. This completes one cycle of the test. Not allowing the crucible to cool below a specific temperature, it is re-filled with the same material and the operation of heating and cooling is repeated.

The life of the crucible is assessed by the number of cycles it can withstand before being unserviceable (*see* **4.2.5**).

3. TEST MATERIAL AND EQUIPMENT

3.1 Test Material — Material to be used for the test shall be brass of grade CuZn40 as specified in IS: 1264-1981†. The melting point of this material is 905°C.

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*Specification for clay-bonded graphite crucibles.

†Specification for brass ingots for gravity die castings and brass gravity die castings (including naval brass) (*second revision*).

3.1.1 By mutual agreement between the purchaser and the manufacturer, cast iron, copper or aluminium may also be used as a test material instead of brass. When such material is used, it may be expected that the number of cycles may vary from the number of cycles obtainable when using brass, to the following extent:

Material	*Variation*
Cast Iron	30 percent less
Copper	30 percent less
Aluminium	50 percent more

3.2 Thermocouple — A thermocouple, preferably with a recording pyrometer, shall be used to measure the temperature of the furnace. An optical pyrometer may also be used, if the metal temperature can be measured accurately.

3.3 Furnaces — The furnace used for heating of the crucible shall be either of the following two types:

a) Coke fired pit type furnace, and

b) Oil fired tilting type furnace.

3.3.1 The furnace atmosphere sbould be suitably controlled to prevent undue oxidation.

4. PROCEDURE

4.1 Coke Fired Pit Type Furnace

4.1.1 Prior to lowering the crucible, the coke bed shall be ignited. The crucible shall be seated carefully in the pit and shall be adjusted concentrically in the coke bed. The crucible shall not be held too tightly either while lowering it into the coke bed, or raising it from the same, to avoid physical damage. The annular space, normally 200-250 mm around the crucible should be filled up to the top level of the crucible with hard foundry coke. The furnace is then heated up to red heat (about 800°C) gradually, to avoid cracking of the crucible due to thermal shock, and after the crucible is red-hot, the material is charged. If the material is in the form of large pieces or ingots, tongs should be used for charging the crucible to avoid mechanical damage. The material shall be superheated 100°C above its melting point. The temperature shall be measured either by a thermocouple or by an optical pyrometer.

4.1.2 During melting, charcoal or coke shall be added to prevent oxidation of the metals. The crucible shall be covered with a lid suitably to prevent radiation loss.

4.1.3 After the metal is completely molten, the crucible shall be lifted out by suitable tongs, gripping the crucibles, without damaging the crucible wall. The metal is then poured into the moulds. The crucibles shall be put back immediately after pouring the metal and shall never be allowed to cool below 500°C to prevent thermal shock. The cycle of charging and recharging shall be repeated and the previously melted metal shall be reused for subsequent charges.

4.1.4 The crucible may be discarded when it developes a deep crack which would adversely affect performance or when the crucible thins out too much such that it weakens the handling of crucible.

4.2 Oil Fired Tilting Type Furnace

4.2.1 The crucible shall be kept on stand made of graphitic material. The crucible shall have suitable side support with allowance for thermal expension so that it would be stable when it is placed in the furnace and during the tilting operation. The dried crucible shall be lowered in the furnace on a stand and the burners shall be slowly started. The burners shall be so adjusted that the flame will be tangential to the crucible wall without direct impingement.

4.2.2 When the furnace is red hot the metal shall be charged. The metal shall be superheated 100°C above its melting point. The temperature shall be measured either by a thermocouple or an optical pyrometer.

4.2.3 During melting, charcoal or coke shall be added to prevent oxidation of the metal. The crucible shall be covered with a lid suitably to prevent oxidation of the metal and radiation loss.

4.2.4 After the metal is completely molten it shall be poured out by tilting the furnace. The crucible shall not be allowed to cool below more than 500°C to prevent thermal shock. The cycle of charging and recharging shall be repeated and the previously melted metal may be reused for subsequent charges.

4.2.5 The crucible may be discarded when it develops a deep crack which would adversely affect the performance or when the crucible thins out to such an extent that its handling with tongs becomes difficult.

4.3 In case the test extends more than 16 hours by any of the two methods given under **4.1** and **4.2**, the furnace may be stopped and restarted next day following the same procedure.

5. RESULT

5.1 During the cycles of melting, the crucible shall be observed for development of cracks, pits, deformations, etc. The observations shall be reported.

5.2 The total number of melting cycles that a crucible withstands, shall be reported.

(*Continued from page* 2)

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